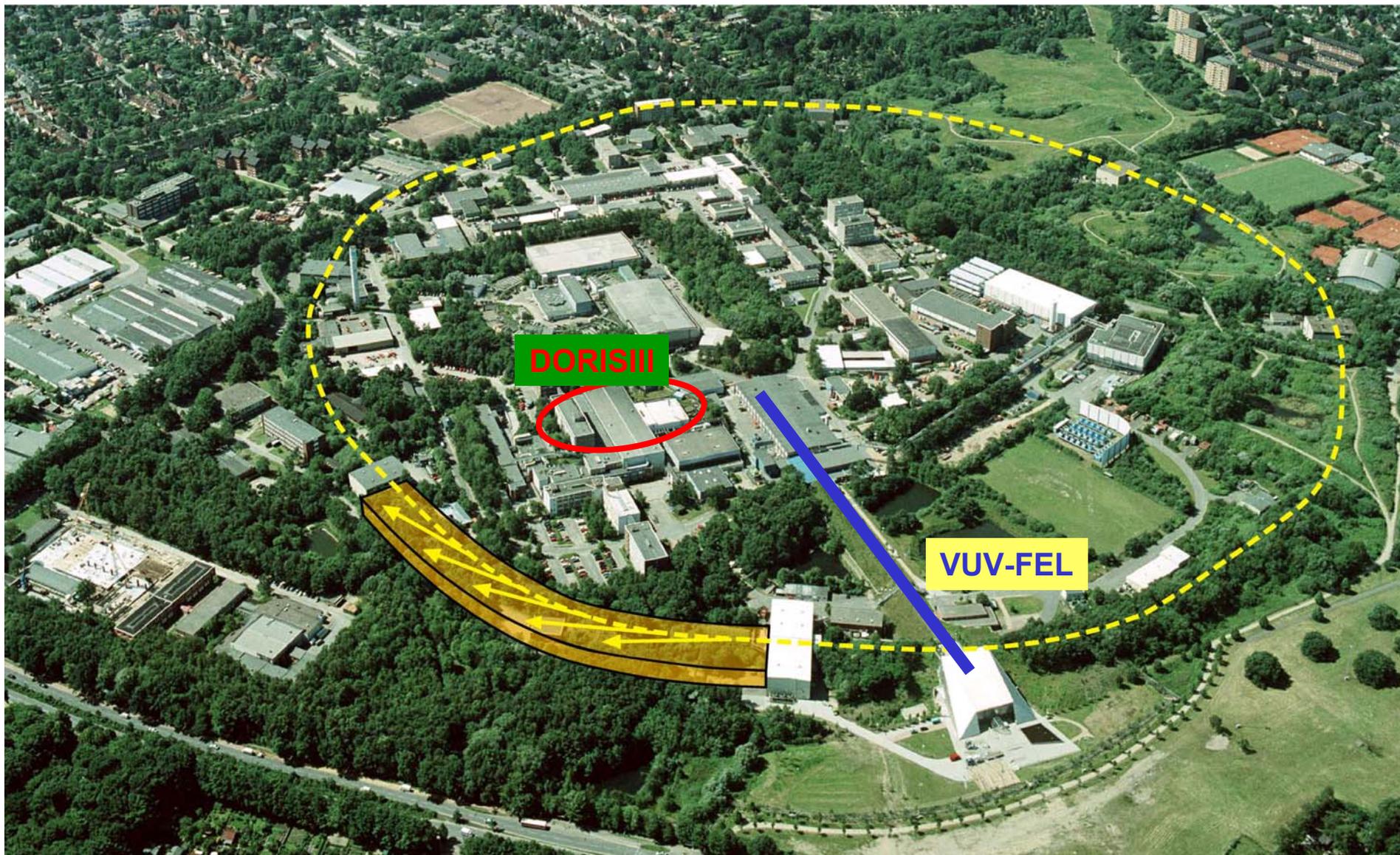


PETRA-III: A New High Brilliance Synchrotron Radiation Source at DESY

E.F. Weckert, K. Balewski, W. Brefeld, W. Decking, W. Drube, H. Franz, P. Guertler, U. Hahn, J. Pflüger, H. Schulte-Schrepping, M. Tischer, J. Schneider



<http://www-hasylab.desy.de/facility/upgrade/main.htm>



PETRA III: Technical specification

1. Positron energy: **6GeV**
2. Positron current: **100mA (aim for 200mA)**
3. Emittance: **1nmrad (damping wigglers)**
4. Coupling: **1%**
5. Beam life time: **$\approx 24\text{h}$**
6. No. of straight sections: **8(5m) + 1(20m)**
7. Canted undulators: **≈ 8 (2m)**
8. No. of independent undulators: **≈ 13**
9. Number of bunches: **$\approx 40-960$**
10. **Topping up operation mode**

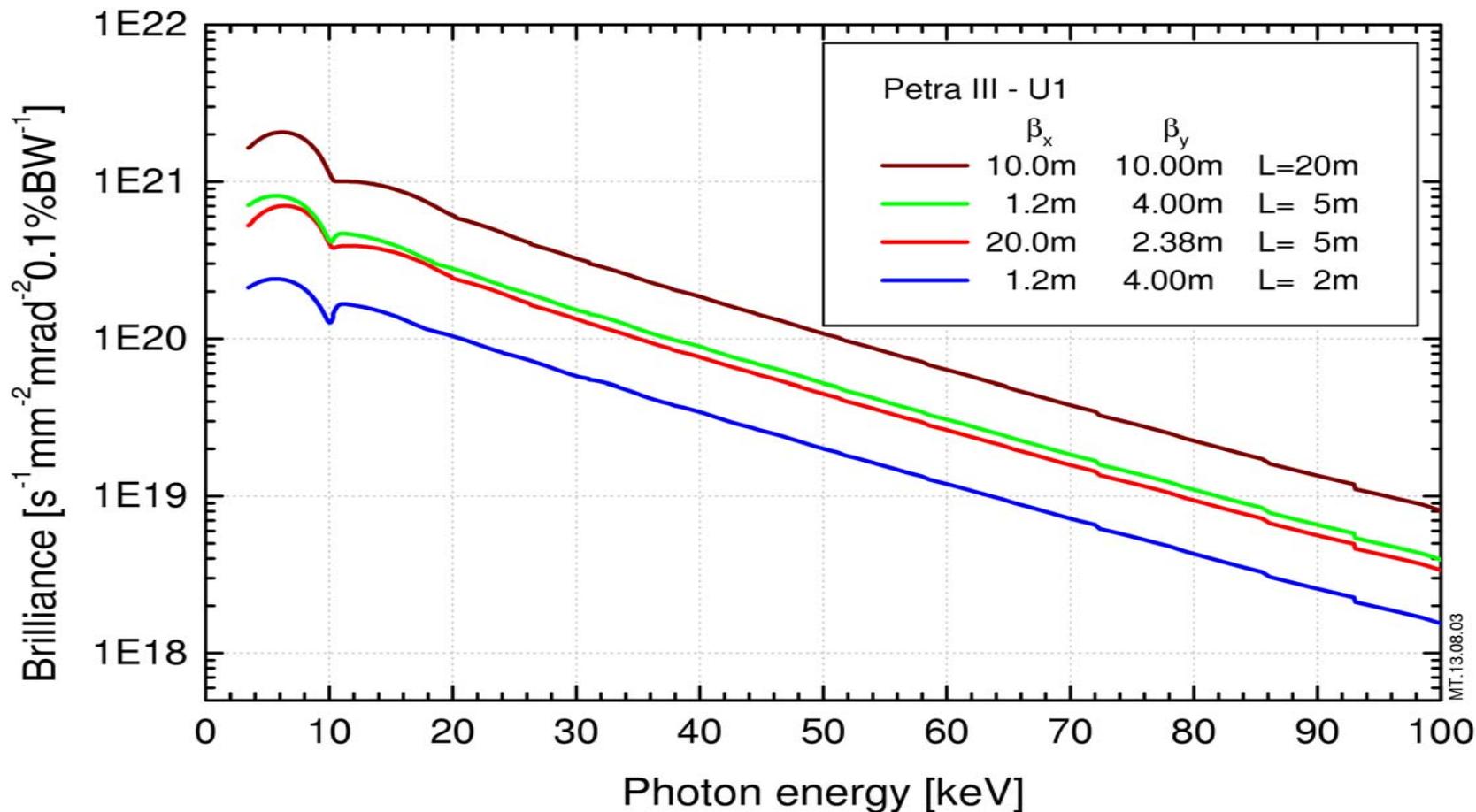
Poster: **2.79** Brefeld, Balewski, Decking, Li, Sahoo



PETRA III beta functions in comparison

	β_x [m]	β_y [m]	Σ_x [μm]	Σ_y [μm]	$\Sigma_{x'}$ [μrad]	$\Sigma_{y'}$ [μrad]	ID-length [m]
low- β	1.2	4	34.5	7.3	29	5.2	5
high- β	20	2.38	141	4.2	8.6	5.2	5
20 m-ID	16	10	126	10.7	8.2	2.7	20
DW-drift	16	16	126	12.7	10.5	4.4	5
ESRF low- β	0.5	2.73	60	8.4	89.3	6	5
ESRF high- β	35.2	2.52	403	8.2	11.8	6	5
Spring-8	24.6	3.9	290	7	12.7	5	4.5
APS	15.9	5.3	217	12.6	15.3	5.7	4

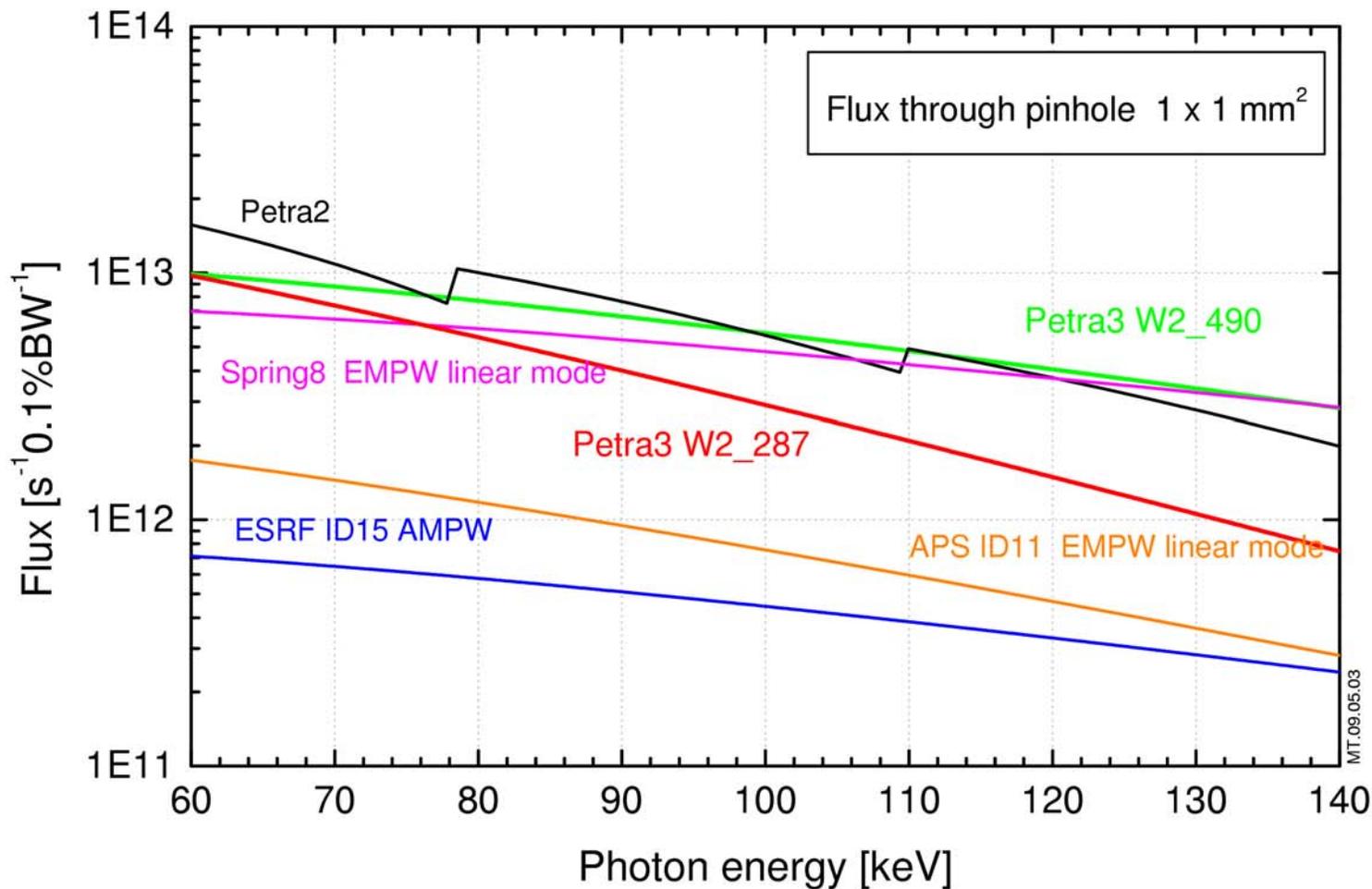
Brilliance of PETRA III undulators



emittance: 1nmrad, 1% coupling, 100mA, **K=2.2**, min. gap: 9.5mm, 29mm period

Flux at higher energies

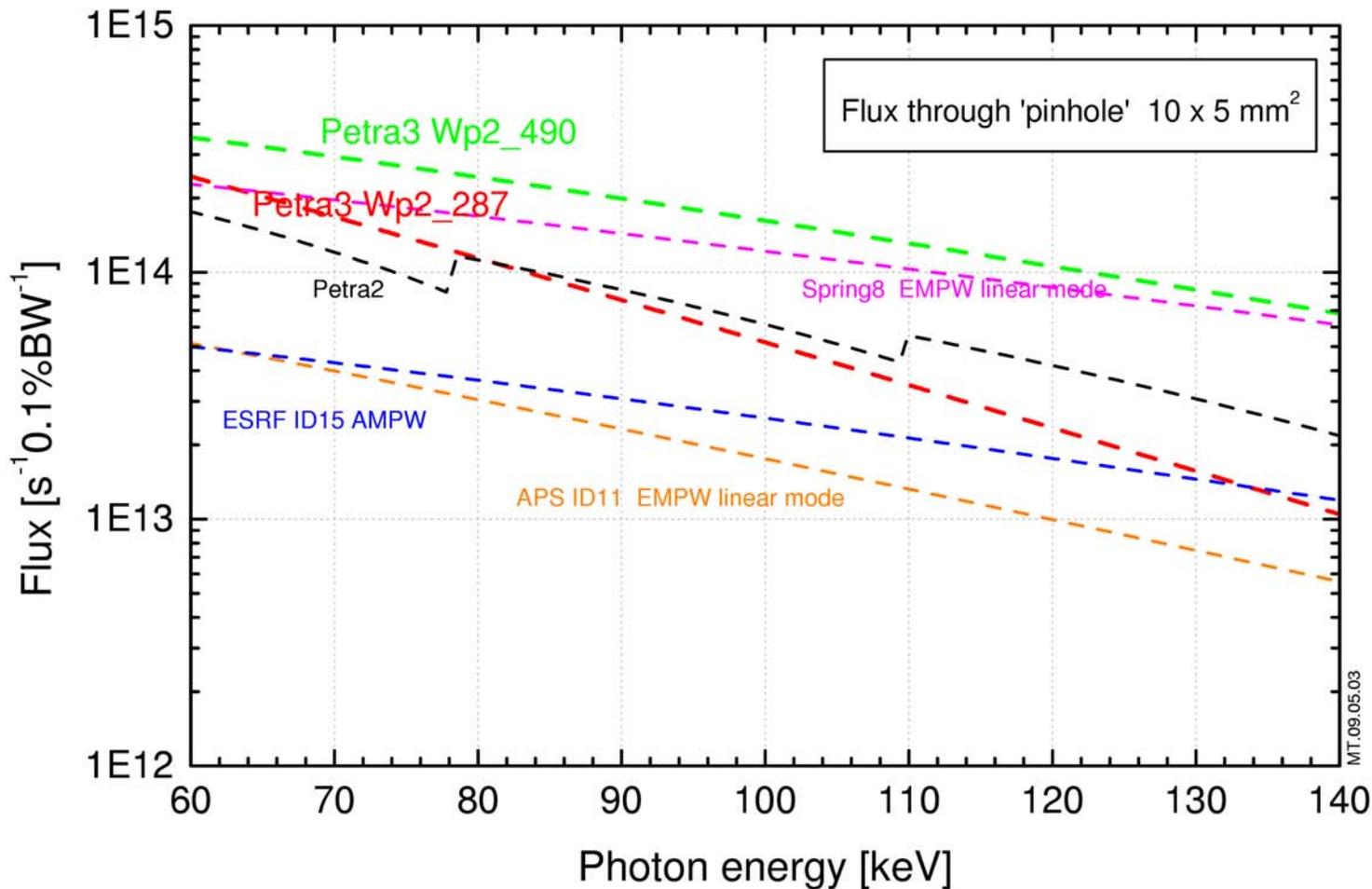
High Energy ID --- U2



distance source - pinhole: 35m, ID-length_{PETRAIII}=5m

Flux at higher energies, large beam

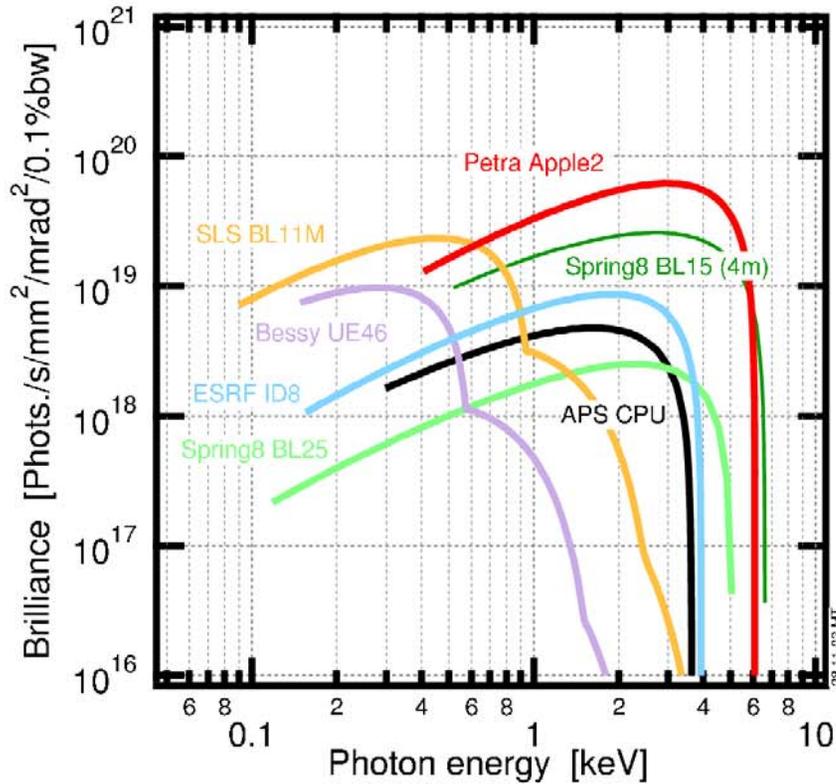
High Energy ID --- Up2



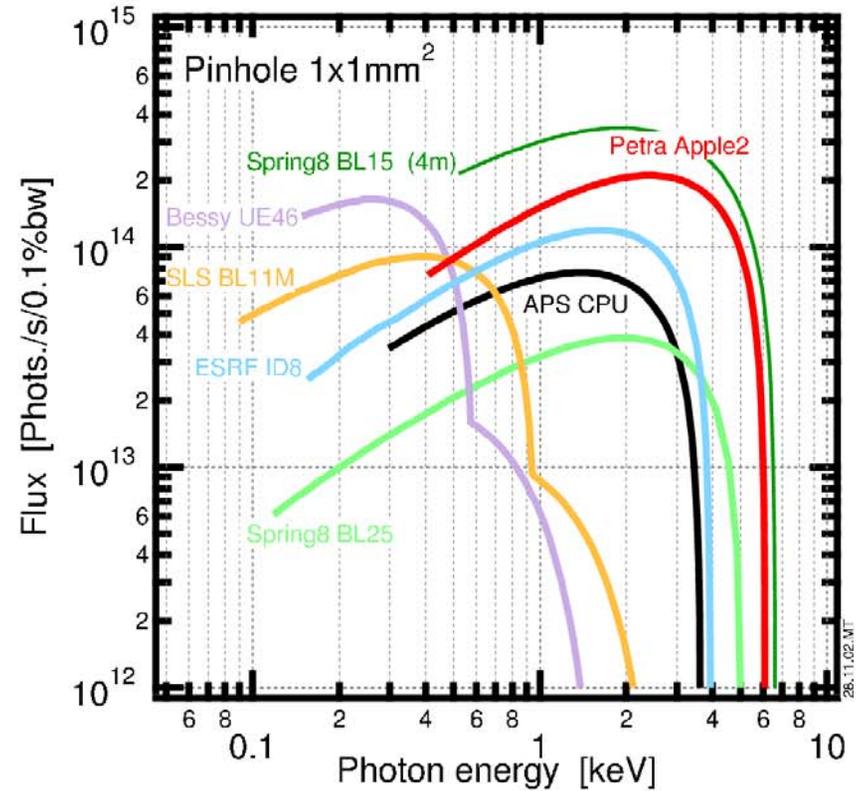
MT.09.05.03

distance source - pinhole: 35m, ID-length_{PETRAIII}=5m

Comparison of VUV and soft X-ray devices



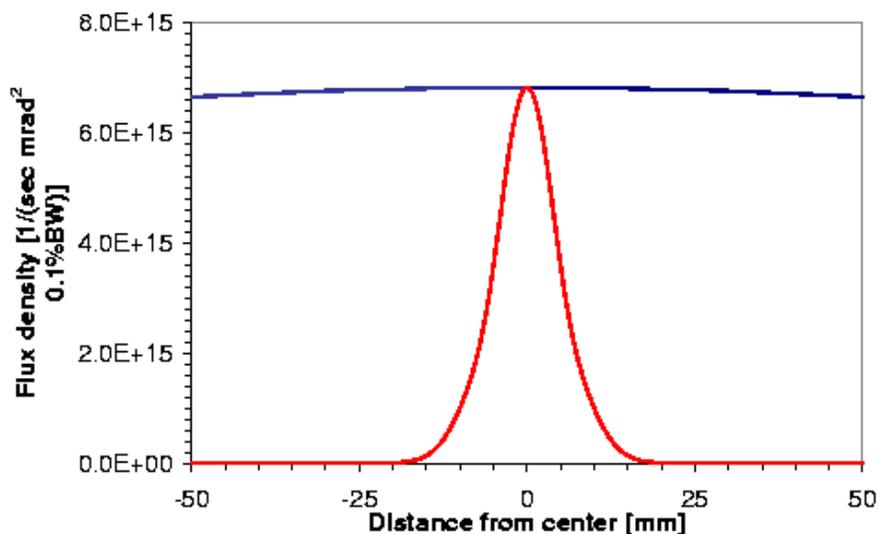
normalized device length is 2m



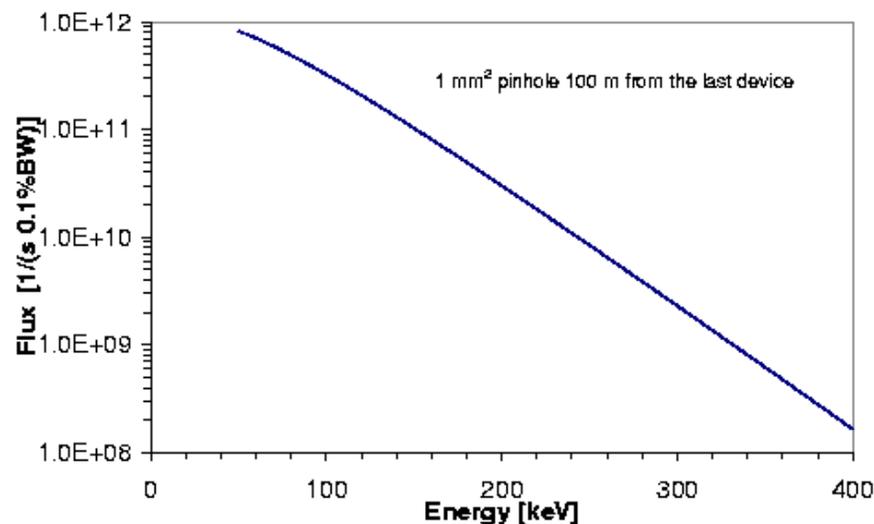
pinhole at 35m distance

Flux of the damping wigglers

from two 12m devices 100m apart and in 100m distance
 $K=28$, $B=1.5T$



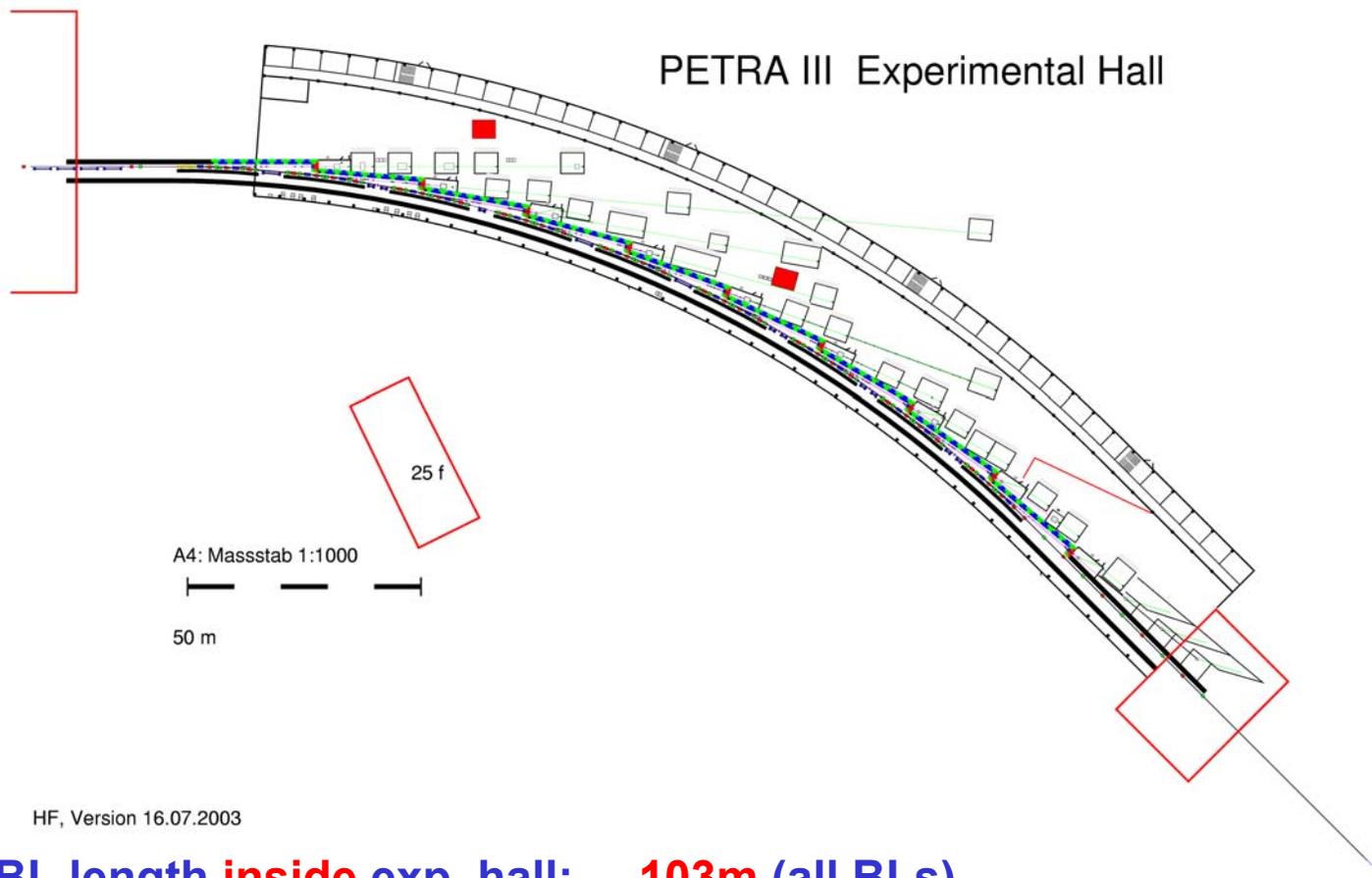
a



b

total length of all damping wigglers: **80m**
 more appropriate devices are possible if wiggler radiation is to be used.

Tentative layout of the experimental floor



HF, Version 16.07.2003

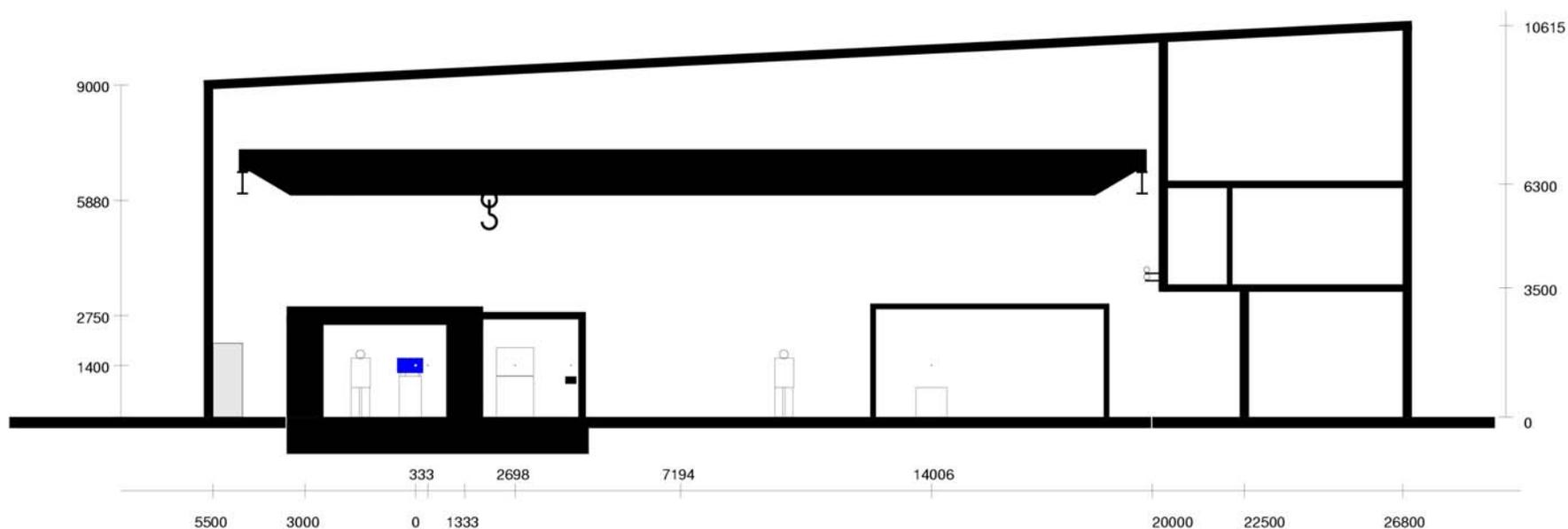
max. BL length **inside** exp. hall: **103m** (all BLs)
max. BL length **outside** exp. hall: \approx **150m** (2 BLs)

Cross section through the exp. hall

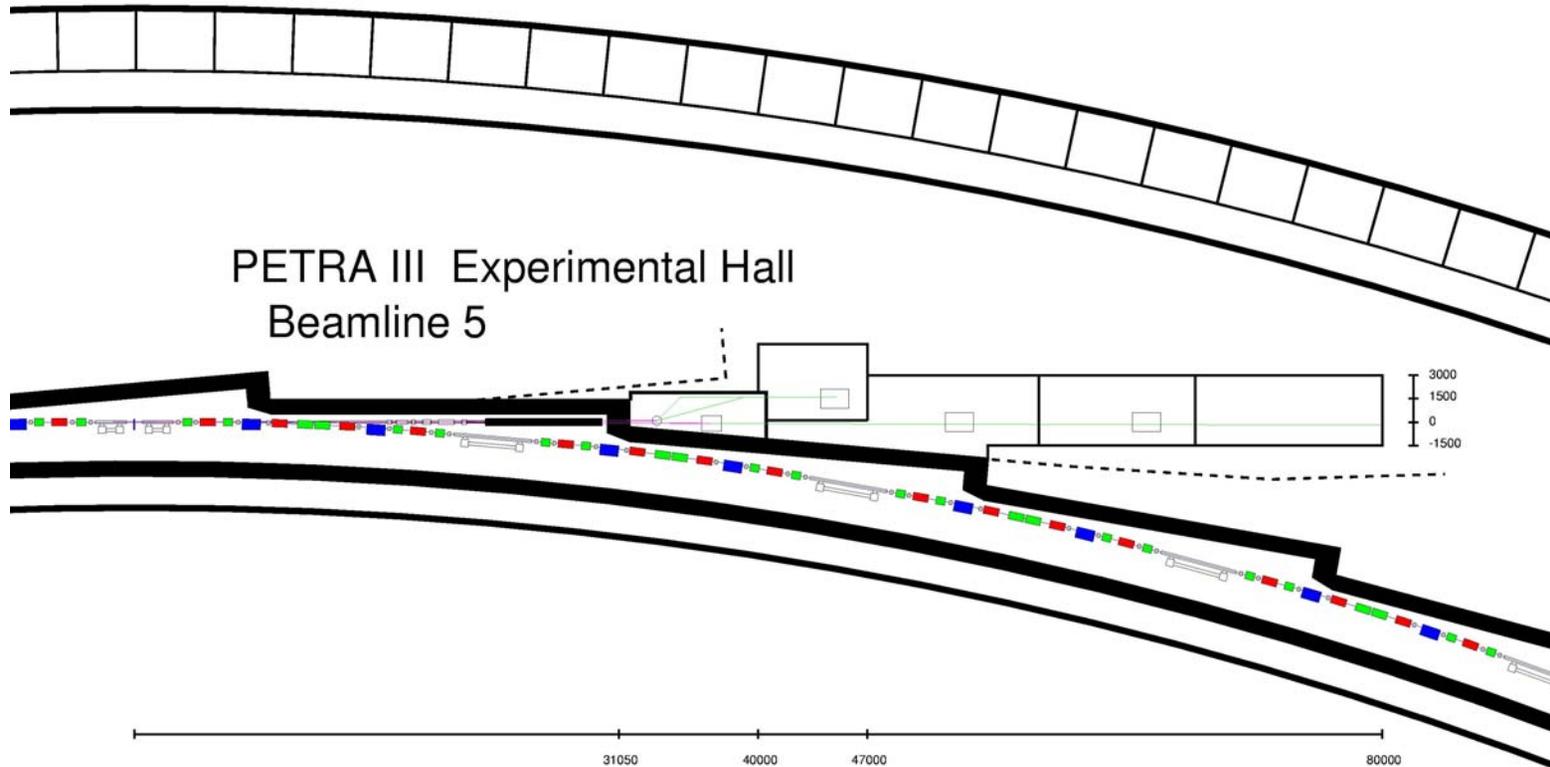
PETRA III Experimental Hall

Cut 12 through second dipole in cell 4

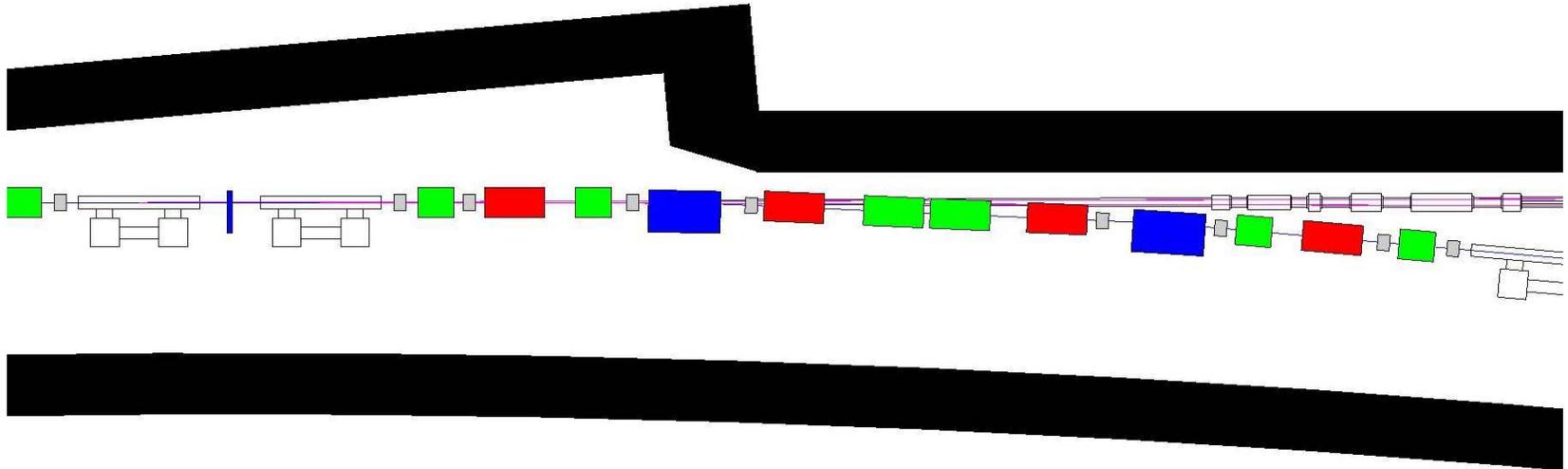
beam separation is 332.5, 2698.2, 7194.2 and 14005.6



Inclined undulator stations

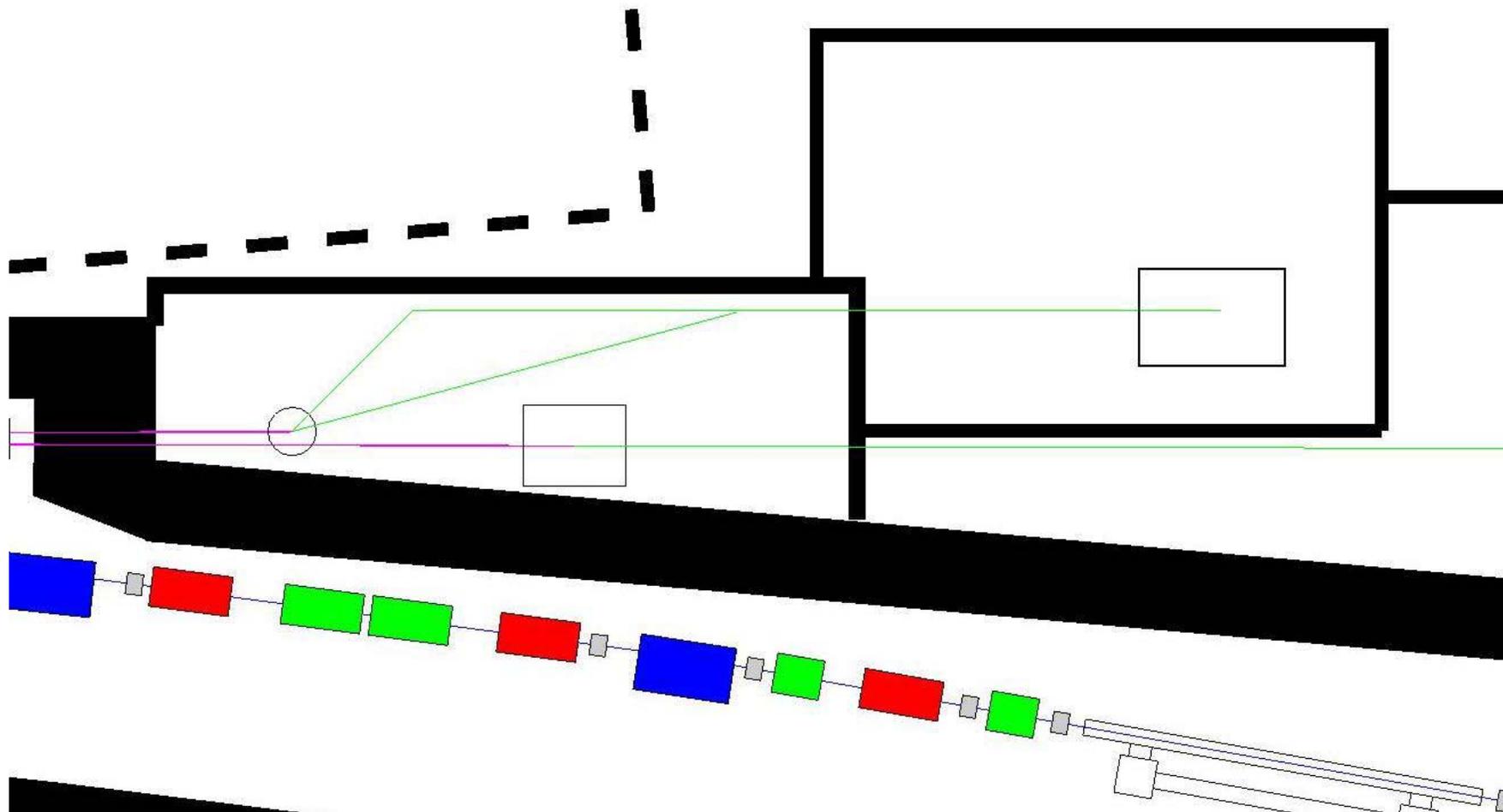


Inclined undulator stations



5 mrad angular offset

Inclined undulator stations



Petra III: Upgrade User Workshops

- | | |
|-------------------------------|-------------------------|
| 1. Materials Science: | 21.+22.3.2002 |
| 2. Biology: | 13.+14.9.2002 |
| 3. Spectroscopy: | 18.9.2002 |
| 4. Condensed Matter: | 30.9.-2.10.2002 |
| 5. XUV: | 31.10.-1.11.2002 |
| 6. WS on exp. Stations | 26.5.-28.5.2003 |

Proposed PETRA III beamlines

- IXS, nuclear scattering, RIXS
- **MAD-capable protein crystallography**
- SAXS (biological, material science)
- **soft X-ray, VUV, magnetic scattering**
- materials science, high energy diffraction, powder-diff., magnetic diffraction high- β
- **materials science, diffraction, micro focus, micro-tomo., low- β**
- coherence application, XPCS, phase contrast imaging, low- β
- **μ -fluorescence (tomography), XAFS, low- β**
- high resolution diffraction, crystallography, surfaces, high- β
- **XAFS (biological, materials science), emission spectroscopy**

Organisation / time scale

- **Fall 2003: TDR**
- **in 2004: official project start**
- **Jan. 2007: start of reconstruction**
- **in 2009: user operation**

- **Since mid 2002: PETRA III project group**
K. Balewski, W. Brefeld, H. Franz, E. Weckert
- **Since mid 2002: first BMBF funds**
7 engineers, 1 scientist, in addition 2 post docs, 2 engineers and 1 scientist from DESY-M

- **Feb. 5th 2003: BMBF decision for PETRA III reconstruction**

Summary

- **PETRA III**: state of the art high brilliance SR source from 2008 on
- **13** undulators, energy: **6 GeV**, emittance: **1 nmrاد**
- several upgrade options (long undulators) for the future
- DESY environment: **DORIS III + VUV-FEL + PETRA III + X-FEL**
interesting infrastructure for research with photons

Poster: **2.75** Tischer, Pflüger

Poster: **2.79** Brefeld, Balewski, Decking, Li, Sahoo

Poster: **2.131** Hahn, Schulte-Schrepping